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MINERALOGICAL AND GEOCHEMICAL ANOMALOUS DATA OF THE K-T BOUNDARY SAMPLES; Y. Miura, G. Shibya, M. Imai, N. Takaoka* and S. Saito*; Dept. Min. Sci. & Geology, Fac. of Sci., Yamaguchi University, Yamaguchi, 753, Japan. *) Dept. Earth Sci., Fac. of Science, Yamagata University, Yamagata, 990, Japan.

Cretaceous and Tertiary boundary (designated as K-T boundary in this study) problem has been discussed previously from the geological research, mainly by fossil changes [1,2]. Although geochemical bulk data of "Ir anomaly"[2] suggest the extra-terrestrial origin of the K-T boundary, the exact formation process discussed mainly by mineralogical and geochemical study has been started recently [3,4,5], together with noble gas contents [6].

The K-T boundary sample at Kawaruppu-river, Hokkaido has been collected in this study, in order to compare with the typical K-T boundary samples of Gubbio, Italy, Stevns Klint, Denmark, and El Kef, Tunisia. The experimental data of the silicas and calcites in these K-T boundary samples have been obtained from the X-ray unit-cell dimension (i.e. density), ESR signal and total linear absorption coefficient, as well as He and Ne contents.

The following results have been obtained in the Kawaruppu K-T boundary samples (cf. Fig. 1): (1) volume percentages and grain-sizes of the constituent minerals within the K-T boundary are changed abruptly, together with abrupt changes of the physical properties of unit cell parameters, X-ray absorption coefficient and ESR signal A (g=2.0050). The abrupt change of the physical properties is not the same within the K-T boundary sample-series. (2) the similar abrupt change of the physical properties (see Fig. 1) has been observed in the Denmark, Italy and Japan-Hokkaido K-T boundary samples. The exact point-level of the abrupt change is nearly consistent with the compositional change of trace elements, such as Pt-group and siderophile elements. (3) Danish K-T samples show the typical abrupt changes, but the Italian K-T samples have effects from much more terrestrial (volcanic) activities. Compared with these typical K-T boundary samples, the Japanese K-T boundary samples indicate the two or three different patterns. The mixed patterns of the Japanese K-T boundary samples are very difficult to explain as the real pure K-T boundary samples, if it is not compared with the typical (Danish) K-T boundary sample patterns.

The shock features of quartz in the K-T boundary samples are considered to be impact relict mineral [7], though there are no detail discussions on the sample location within the K-T boundary. Figure 1 indicates that abrupt change in the cell-volume of the quartz crystal is observed in special place within the K-T boundary. The anomalous quartz with relatively higher density can be distinguished with volcanic quartz with normal density.

Anomalous changes of physical properties of calcite in the K-T boundary which are completely different with the typical terrestrial limestones from the Akiyoshi-Kaerimizu boring cores (Yamaguchi, Japan) have been obtained in the samples from Denmark, Italy and Japan. Anomalous high total dose in the Danish calcite is due to inclusion of Ir elements, which can be obtained from trace analysis with the JXA-8600 micro-probe. The calcites from

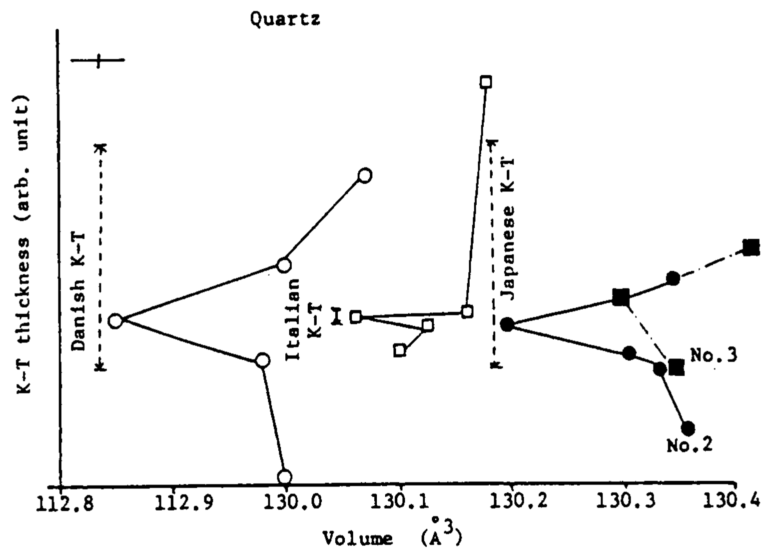

Fig. 1. Anomalous peaks of quartz crystals in the K-T boundary samples from Denmark, Italy and Japan. Two sampling series in the Japanese K-T boundary show different behaviors. Maximum peaks are observed at one fifth from the bottom of end of the Cretaceous period.

Italy and Hokkaido, Japan with highly terrestrial alteration show various changes of ESR data within the successive K-T boundary.

The carefully collected Danish K-T sample shows the high He ratio ($^3He/^4He=9.7x10^{-5}$) and the low Ne ratio ($^{20}Ne/^{22}Ne=9.43$, $^{21}Ne/^{22}Ne=0.0358$), which are inconsistent with the isotopic signature reported for the both deep-sea sediments [8] and diamonds [9]. Although the high He ratios found in the lavas are attributed to cosmogenic ^3He produced by cosmic-ray interation with lavas at high mountains [6,10], the sampling site at Stevns Klint is not at altitudes but on a sea shore, and was underground in the past without intrusion of cosmic-rays in the K-T boundary. These suggest that the existence of a noble gas component is different from that identified in the terrestrial materials mentioned above. The noble gas of the same trend as found in the present K-T sample is observed in meteorites; that is, it is the cosmogenic gas or the planetary-type gas.

The K-T boundary samples are usually complex mixture of the terrestrial activities after the K-T boundary event. The mineralogical and geochemical anomalous data in this study indicate special terrestrial atmosphere at the K-T boundary formation probably induced by asteroid impact, followed the many various terrestrial activities (especially the strong role of sea-water mixture, compared with terrestrial highland impact and impact craters in the other earth-type planetary bodies).

References 1) Alvarez, L.W., Alvarez, W., Asaro, F. and Michel, H.Y. (1980): Science, 208, 1095-1107. 2) Saito, S., Yamanoi, T. and Kaiho, K. (1986): Nature, 323, 253-255. 3) Miura, Y. (1986): Lunar and Planetary Science (NASA-LPI), 17, 555-556. 4) Miura, Y., Ohkura, Y., Ikeya, M., Rucklidge, J., Takaoka, N. and Nielsen, T. (1985): ESR Dating and Dosimetry (Ionics, Tokyo), 1, 469-476. 5) Miura, Y. and Imai, M. (1988): 13th Symp. Antarctic Meteorites (NRPR, Tokyo), pp.2 (in press). 6) Takaoka, N. and Miura, Y. (1988): Ibid.,pp.2 (in press). 7) Bohor, B.F., Foord, E.E., Modreski, P.J. and Triplehorn, D.M. (1984): Science, 224, 867-869. 8) Amari, S. and Ozima, M. (1986): Terra Cognita, 6, 102. 9) Honda, M. (1986):Ibid. 6, 104. 10) Kurz, G. (1986): Geochim. Cosmochim. Acta, 50, 2855.